AS800 MV Drives Power Industry Application

1. Project overview

Shanghai Laogang Renewable Energy Utilization Center daily incineration of municipal solid waste 3,000 tons, installed advanced flue gas treatment system and power generation equipment. It's one of the biggest garbage disposal facilities and the most environmentally friendly facilities. The project started construction in August 2010 and was completed and put into trial operation in May 2013. After the project is put into operation, while processing 1 million tons of domestic waste annually, the annual power generation capacity can reach about 250 million kWh, and the annual online power consumption is about 200 million kWh. The slag after incineration will be comprehensively reused, such as landfill covering materials, brick making, paving and so on.

This project uses 13 units of STEP AS800 MV drives, including 4 primary fans, 6 feed water pumps, and 3 circulating water pumps. This article uses this project as an example to introduce the application characteristics of AS800 MV drivess on fans and pumps in the power industry, and to explain the field application process, inverter technical characteristics and application effects.

2. Field Process

- **Circulating pump technology**

In the circulating water pump system, the circulating water pump realizes the recycling of water resources. The hot water at the outlet of the condenser enters the cooling tower. After the heat of the circulating water is transferred to the atmospheric temperature, the pressure is increased by the circulating water pump and enters the condenser Cooling the low-pressure cylinder exhaust, because the system water level is basically stable, the head of the circulating water pump is also basically stable, which means that the size of the circulating water pump determines the power consumption of the circulating water pump.

As the unit load and the external environment change, the vacuum is constantly changing, so the circulating water volume needs to be adjusted in time to ensure the unit's safe and economical operation. During normal operation in winter, the low-speed operation of a circulating water pump is sufficient to meet the cooling needs of the unit; however, in the season with large temperature differences and large load changes, although the circulating water pump is adjusted in high and low speeds, it cannot guarantee The unit operates in an economical manner, resulting in high plant power usage and high power generation costs, so it is necessary to adjust the frequency of the water pump.

Use MV drives to adjust the speed of the circulating water pump motor according to actual needs,

and then adjust the amount of cooling water of the pump, which can reduce the power of the motor and achieve the most favorable vacuum control purpose, thereby ensuring and improving the operating conditions of the generator, and can achieve the effect of energy saving.

In order to reduce the power consumption of the factory and reduce the cost of power generation, Shanghai Laogang Renewable Energy Utilization Center decided to install a new water pump AS800 series MV drives to a circulating water pump of the power plant to achieve a cost-effective operation mode.

- **Garbage power plant boiler technology**

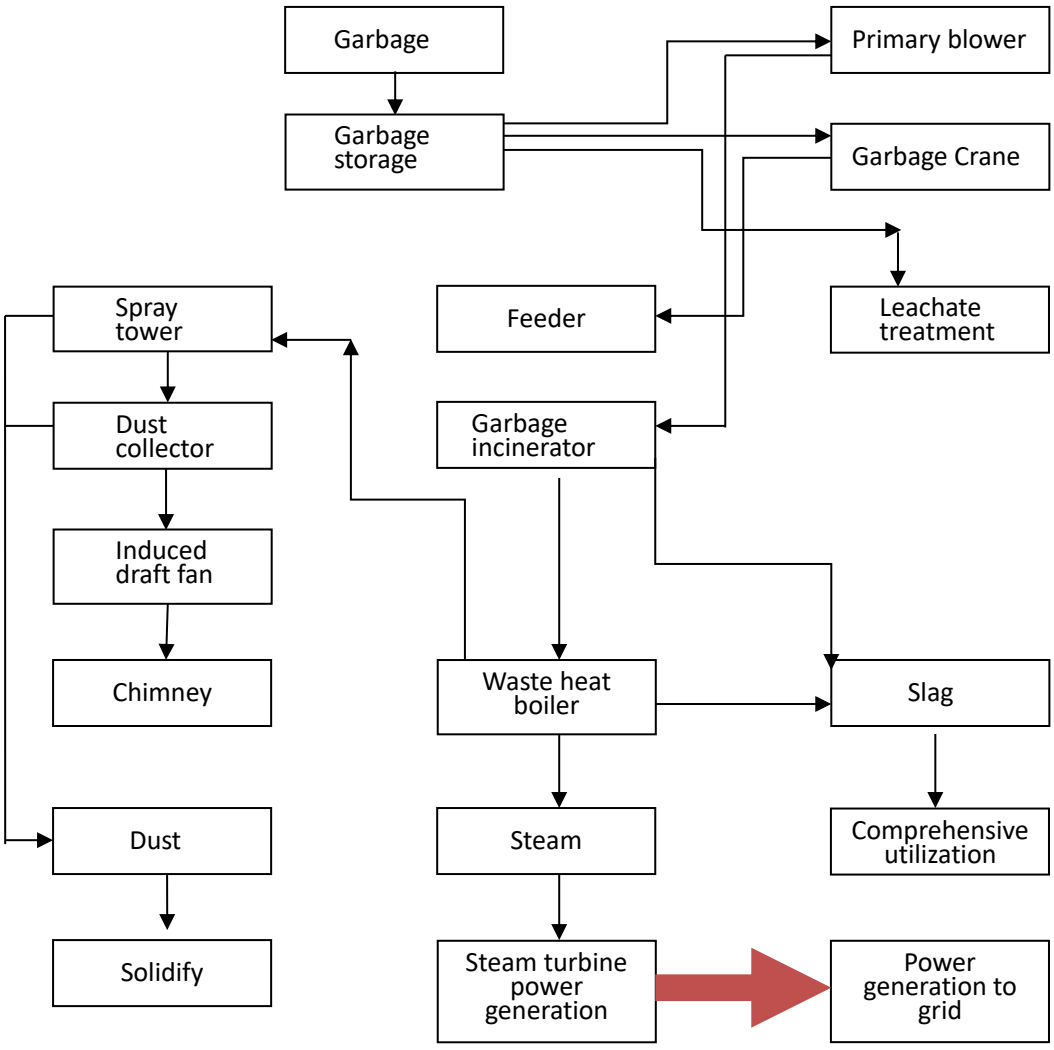

Figure 1 garbage power plant boiler process

Garbage power plant boiler process is shown in Figure 1. Garbage power plant boiler system including primary blower, draft fan system. In actual operation, The primary fan system mainly draws the combustible gas in the garbage storage pit to the garbage incinerator to generate heat for combustion and supply steam to the boiler to drive the steam turbine to generate electricity, At the same time, to prevent gas leakage (gas is toxic), primary fan is an important device in the

application, it must ensure the reliability of operation. Induced draft fan system is to create negative pressure in the furnace during power generation to suck off the exhaust gas. The impact is also important on the entire power generation system. The shutdown of the induced fan may cause the boiler fire extinction.

3.Inverter system configuration

According to the working condition demand of the field load, considering that the inverter will not affect the production after quitting operation, the system can be ensured to work normally,system shall be configured with power grid bypass,When the inverter fails, switch the motor to the power grid.One - drag - one automatic bypass scheme is suitable for easy operation, Or the inverter can be automatically switched to the power grid after the failure of the operation.

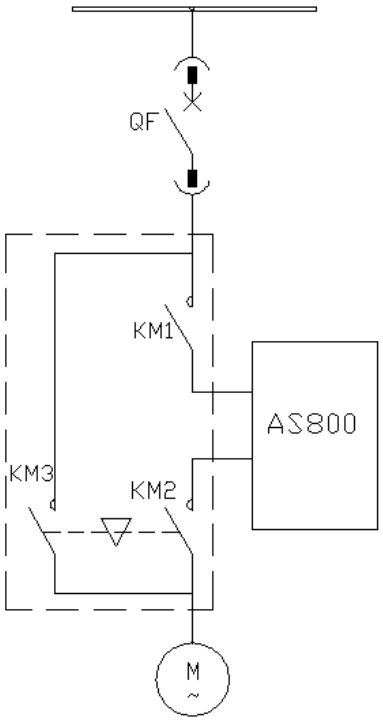

图 2 Inverter system primary circuit

According to the working condition demand of the field load, considering that the inverter will not affect the production after quitting operation, the system can be ensured to work normally,system shall be configured with power grid bypass,When the inverter fails, switch the motor to the power grid.The three contactors in figure 2 are installed in the bypass cabinet, In order to ensure that no power is sent back to the output end of the inverter, KM2 and KM3 realize natural

mechanical interlock。When KM1 and KM2 are closed and KM3 is disconnected, the motor runs in the state of frequency conversion. When KM1 and KM2 are disconnected and KM3 is closed, the motor runs by power grid.

4.AS800 High Voltage Drive Technical Features

- Ideal mechanical power: the output current contains extremely small high-order harmonic components, resulting in the impact of the pulsating torque on the shaft system can be ignored, reducing the vibration of the motor.
- Multiple curve selection functions: under VF control mode, AS800 series high-voltage drive can provide multiple curve algorithms to adapt to different load process requirements according to different load characteristics.
- The high-voltage frequency conversion must meet the load requirements of the water pump on site, as well as the needs of dynamic response and rapid braking operation.
- The frequency converter adjusts the rotation speed of the motor to adjust the water volume, so that the output power of the motor is basically proportional to the water demand, so that the motor can work efficiently all the time, so as to achieve obvious power saving effect.
- The system has an automatic control bypass cabinet, which can provide sufficient contacts for the front operation platform of the furnace.
- The system has two sets of control loops of frequency conversion and power frequency, and has the function of single module bypass to increase the redundancy of frequency drive.
- It can make the current rise smoothly without any impact when the motor starts and loads; it can make the motor realize soft stop, avoid the harm caused by the reverse current, and help to extend the service life of the equipment.
- Through the phase-shifting rectifier transformer, the input harmonic current at the grid side is greatly suppressed, and the voltage superposition is realized by cascading the multi-level H-bridge power units to obtain nearly perfect high-voltage sine wave output, which can directly drive the high-voltage motor without any filter.
- Because the motor operates in high efficiency state, the power factor is high, the reactive power loss is reduced, and a large amount of electric energy is saved.

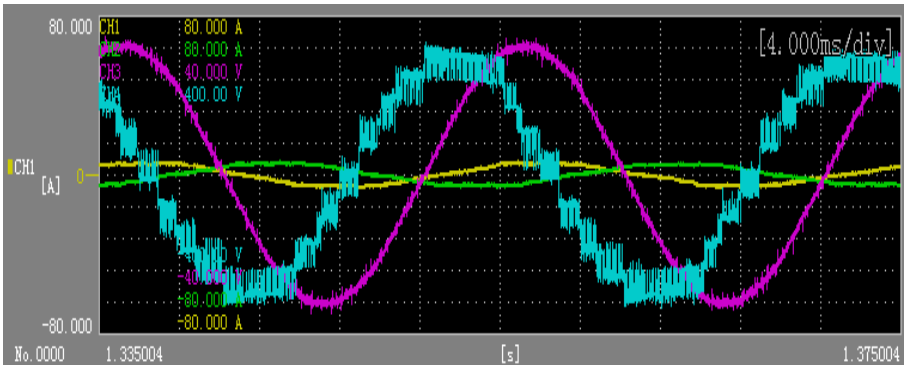

FIG 3 Field measured output voltage and current waveform.

5.Application effect analysis

(1) Save energy. Compared with the traditional fan, water pump, energy saving is the most practical significance for the fan, water pump controlled by frequency converter. It is an economic operation state to adjust the rotation speed of fan, water pump according to the demand of on-site raw material.

(2) Reduced operating costs. The operation cost of traditional fan, water pump consists of three parts: purchase cost, maintenance cost and energy cost. Among them, the energy cost accounts for about 60% of the operating cost of fan and water pump. Through the reduction of energy cost and the reduction of impact on the equipment after the frequency conversion start, the maintenance and repair amount will also be reduced, so the operation cost will be greatly reduced.

(3) Prolong the service life of fan and water pump. When the frequency drive starts the fan water pump from 0Hz, its starting acceleration time can be adjusted, so as to reduce the impact on the electrical and mechanical parts of the fan, water pump caused by starting, enhance the reliability of the system, and extend the service life of the pump. In addition, the frequency control can reduce the current fluctuation when the unit starts, which will affect the power consumption of the power grid and other equipment. The frequency drive can effectively reduce the peak value of the starting current to the lowest level.

(4) Reduce equipment noise. According to the working condition requirements of the fan and water pump, after the transformation of frequency conversion and speed regulation, the running speed of the motor is obviously slowed down, so the noise of the fan and water pump is effectively reduced.

(5) Description of energy saving benefits. According to the analysis of field operation, compared the power consumption with frequency drive and without frequency drive, the energy saving rate is more than 20%, which brings huge economic benefits to users.